

**Report**

01 March – 30 June 2022

Africa RISING:   
Sustainable Intensification of Key Farming Systems in the Sudano-Sahelian Zone of West Africa

Submitted to

**IITA**



***Africa RISING Technical Report Template***

**Reporting Period: 1st March – 30th June 2022**

**Section A. Partner Information**

**A.1. Institution: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)**

**A.2. Contact person: Dr Bouba Traore E-mail:** [**b.traore@cgiar.org**](mailto:b.traore@cgiar.org)

**A.3. Intervention sites, country: Koutiala and Bougouni districts in the Sikasso Region of Mali**

***A.4.* Other Partners**

Association Malienne d’Eveil au Developpement Durable (AMEDD)

Cooperatives of the Mouvement Biologique du Mali (FENABE)

Institut d’Economie Rurale (IER)

International Livestock Research Institute (ILRI)

World Vegetable Center (WorldVeg)

Wageningen University and Research Centre (WUR)

**Section B. Progress/achievements during the reporting period**

**Executive summary of achievements**

1. Manuscript on Microdosing of Compost for Sustainable Production of Improved Sorghum in southern Mali has been published in the journal of Agronomy. <https://www.mdpi.com/2073-4395/12/6/1480/htm>.
2. During the 2021/2022 activity, a manuscript and an extended abstract were developed and submitted accordingly. The manuscript focused on the impact of different fertility sources on sorghum cultivars tested over a three-year growing season (2017-2019) with a title ***“Impacts of fertilization management strategies on improved sorghum varieties in smallholder farming systems in Mali: productivity and profitability differences”*** and submitted for reviewing process in Heliyon journal. The extended abstract titled “***Modeling approach to evaluate micro-dosing fertilization strategy on sorghum productivity under the projected mid-century climate scenario in Mali Savanna agro-ecologies”*** was submittedfor oral presentation at Interdrought VII to be held in Dakar (Senegal) from 28 November to 2 December 2022. Additionally, capacity enhancement training for lead farmers and extension agents in Koutiala and Bougouni regions was organized, titled ***“Good Agronomic Practices (GAPs) for Improved Sorghums productivity in Mali”.*** A total of72 participants attended comprising 54 males and 18 females. We conducted a repeat of the 2020 cropping season on-farm demonstration ‘*production technology on fertilization strategies*’ for sorghum on 47 farmers’ fields, including AfricaRISING technology Park in both regions. The results showed that the fertilization strategies significantly increased grain yield by 41%-72% (Koutiala region) and 32%-45% (Bougouni region) compared to farmers’ practice at the farm level. The on-farm production technology serves as a means of technology diffusion and adoption across Africa RISING intervention communities. Our study has demonstrated increased productivity (grain and biomass) across the farmers’ field compared to traditional practices. While sorghum grain serves as a food and cash income for the farmers, the biomass production could further be used as a source of feed for the livestock as well as an organic matter which can be used for composting or allowed to decompose naturally.
3. Decision support tools (DSTs) have been developed and finetuned over the past years and are currently in use by about 40 farmers in the study sites. In March 2022, a series of training workshops were organized to scale-up the use of the tools in Koutiala district. In total, 145 farmers, 12 relay producers and 24 development agents were trained. Through several feedback workshops with participating farmers, we increased our understanding of the key strengths and weaknesses of the DSTs. In addition, close monitoring of the use of the DSTs allowed us to gain an understanding of the effects of the tools. This information is captured in this report and a peer-review paper that is in progress.
4. Activities that included disease screening trials, postharvest tests, processing, and training sessions were conducted. A survey to determine the inclusiveness of women and youth in the vegetable value chain is being conducted. Training sessions on vegetable postharvest and processing were organized in March 2022 for 257 farmers including 70% women in Koutiala (125) and Bougouni (132) in South Mali. At the request of farmers and partners, two demonstration gardens in sacks were set up in the two technology parks of Madina (Bougouni) and N’Golonianasso to raise awareness of vegetable consumption and improve nutrition. Four vegetable crops (tomato, amaranth, carrot, and onion) varieties were proposed for each technology park.

| **Project Outcome 1: Outcome 1:** Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Output/ Activity** | **Planned Activities** | **Planned Milestones** | **Deviation from Planned Milestone** | **Achievements towards Output** | |
| Output 1.1: Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners | Sub-activity MA1111-21: Evaluating sorghum crop simulation models using different fertility sources and climate model outputs to improve the productivity of sorghum. | Planned Milestones   1. Extension materials on improved sorghum husbandry in form of posters and flyers in both English and French languages. 2. Report on good agronomic practices (GAPs) for higher productivity based on farmer field demonstration. 3. Report on farmers’ field day. 4. Manuscript on fertilization management strategies for smallholder sorghum production systems in Sudanian Mali: yield and profitability variability. 5. A report on simulating the potential yield of sorghums using different fertilization strategies and future climate scenarios. 6. Conference paper on CSMs for different fertility management practices. 7. Contributions towards the development of the West Africa Handbook. | There are no deviations in the planned milestones. | 1. Delivered and uploaded <https://www.slideshar> e.net/africarising/ 2305-249618456 2. In the 2021 cropping season, potential fertilization strategies were established at the farm level across selected communities in Bougouni and Koutiala. In addition, 72 lead farmers and extension agents were trained on good agronomic practices (GAPs) and best fertilization management practices for higher productivity for sorghum production and an extension guide poster titled ***“Steps to Boost Sorghum Productivity in Savannah and Sahelian Region, Mali”***  produced in French and English languages was distributed. 3. At least 400 farmers were reached through on-farm production demonstration plots both at farmer field and technology parks via organized field day and thematic field visits. The detailed report can be accessed via the link below: [Africa RISING: Technology parks herald a new beginning in Mali’s farms – ICRISAT](https://www.icrisat.org/africa-rising-technology-parks-herald-a-new-beginning-in-malis-farms/). 4. Manuscript submitted to Heliyon journal titled *“*Fertilization management strategies for sorghum production in smallholder farming systems in Mali: impacts on yield, agronomic efficiency and profitability*”*, currently under reviewing process of the journal <https://track.authorhub.elsevier.com?uuid=eeeb4805-9839-453b-a7bf-bc4a86b4aa42> 5. The simulation outputs and the analysis completed and extracted into planned milestones 6.6, submitted for a conference presentation. 6. Conference paper on CSMs for different fertility management submitted for oral presentation at **Interdrought VII** to be held in **Dakar (Senegal)** from **28 November to 2 December 2022**. <https://interdrought7.org/abstract-submission/>. 7. Contribution to 4.2.3 Technology 3: Micro-dosing Technology for Improving Sorghum Productivity using both organic manure and inorganic fertilizer applications in Mali has been reviewed by the chapter lead author and editorial team. | |
| Output 1.1  Activity 1.1.1: Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production. | Sub-activity MA1112-21: Understanding soil fertility management in cereal cropping systems in southern Mali. | Planned Milestones   1. Household level nutrient flow data. 2. A report on modelled results on nutrient flow characterized across farm typologies. 3. Methodological report on composting technology. 4. Manuscript on integrated soil fertility management practices under different input and nutrient flow conditions. 5. Manuscript on Microdosing of Compost for Sustainable Production of Improved Sorghum in southern Mali. 6. Contributions towards development of the West Africa Handbook | There are no deviations in the planned milestones | 1. Report uploaded on CGSPACE. <https://cgspace.cgiar.org/bitstream/handle/10568/119232/farm%20nutrient%20dynamics%20Mali_report.pdf?sequence=1> 2. Technical report has been submitted for editing and uploading to the CGSPACE 3. Report has been submitted for editing and uploading to the CGSPACE. 4. Manuscript titled: “Biomass and Nutrient Flow Dynamics from Households to Farm Fields: An Experimental Study in Southern Mali” has been re-submitted to Nutrient Cycling in Agroecosystems (FRES-S-22-00016) after revision. 5. Scientific article published in the Journal of Agronomy <https://www.mdpi.com/2073-4395/12/6/1480/htm>) 6. Revised chapter on Technology 6: Heap Composting Process for soil fertility management has been submitted for internal review. | |
|  | Sub-activity MA1113-21: Evaluating improved dual- purpose sorghum for crop-livestock integration and income generation in Sikasso Region/Mali | 1. Preparation of a summary paper and a poster to be submitted to the Tropentag conference 2. Development of a scientific paper to be submitted to Field Crops Research. 3. Creation of a database to be uploaded on Dataverse 4. Scientific article submitted (with 2 years of data) 5. Finalization of the West Africa Handbook in collaboration with the co-authors as a team: (Sorghum hybrids) under chapter 1 | 1. No  2. No  3. No  4. Yes  5. No | 1. Summary paper available on “The book-of-abstracts of the Tropentag 2021 conference” <https://www.tropentag.de/2021/TT21boa.pdf> 2. Scientific paper to be submitted to Field Crops Research Journal. 3. Shared with the data manager 4. In progress. It has been decided to develop an article mostly based on profitability. The data was sent to a statistician for analysis as per the request of the Chief Scientist. 5. Book chapter was sent to the lead author. | |
|  | MA1114-21  Evaluate and disseminate technologies to control vegetable pests and diseases, reduce postharvest losses, and improve human nutrition | 1. Report on high- performing vegetable varieties with farmer- preferred traits. 2. Report on major vegetable diseases identified in Bougouni and Koutiala districts. 3. Report on farmers’ field days and participatory variety selection for disease resistance. 4. Report on farmers’ training and trial establishment. 5. Database on vegetable diseases, pest assessment6*.* One manuscript on disease resistance/ tolerance in Mali. | 1.No  2. No  3. by end of March 2022  4. No  5. N/A  6. No | 1. Ongoing 2. Ongoing 3. Submitted to the journal 4. In the 2022 dry season, trials to identify/characterize diseases and pests prevailing on tomato and pepper are ongoing in the technology park of Madina in Bougouni District and the technology park of N’golonianasso in Koutiala District. 5. Data are being collected on several farmer- preferred traits including fruit yield, yield components, diseases, and pest scoring to observe the severity and incidence of diseases and pests for each variety. The results will be presented in the final report. |
| Activity 1.1.3:  Test and disseminate integrated crop-livestock-soil systems to increase and sustain productivity and reduce risk. | Sub-activity MA1131-21: Risk management and informed decision making towards sustainable intensification of crop-livestock systems. | 1. MSc thesis and summary report (objective 1) 2. Report on the training activities (objective 2) 3. Paper on farm planning and budgeting tool (objective 3) 4. West Africa Handbook chapters; contribution to chapters 3, 4, 9 and lead of chapter 10 | 1. No  2. No  3. Yes  4. Yes | 1. MSc thesis available (<https://www.dropbox.com/s/g6om1dwgbyjl17m/MSc_Thesis_KenEjiri.pdf?dl=0>) 2. Output is ready and the report shared above 3. Output: Training workshops were organized in March 2021 4. Peer-review paper is in progress, but additional data is needed for completion. 5. Our contributions have been submitted for the chapters, but for chapter 10, contributions from several co-authors are still pending | |
| Activity 1.2.1:  Test and disseminate land, soil and integrated land-soil technologies and practices to improve and sustain productivity and eco-systems services at the farm and landscape/watershed levels. | Sub-activity MA1211-21: Assess cropping management factors using empirical relations, GIS and Remote Sensing tools in two agro-ecologies of Mali. | 1. Report on the vulnerability of landscape patterns from a multidisciplinary approach based on remote sensing (RS) and geographical information system (GIS) determined. 2. Report on Household perception on land management strategies for reducing soil erosion and soil fertility improvement. 3. Publication based on both reports. 4. Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | There are no deviations in the planned milestones. | Delivered   1. [https://hdl.handle.net/10568/113775](https://hdl.handle.net/10568/113775" \t "_blank) 2. Report submitted to Africa RISING Chief Scientist for review. 3. Manuscript submitted and returned with major revision. Revised manuscript uploaded on the Journal of Agriculture and Food Security 4. Handbook chapter submitted and under internal review. | |
| Sub-activity  MA1212-21  Improving crop-livestock productivity and household income through the use of contour bunding and agroforestry options. | 1. Report on farmers’ training on nursery based agroforestry using fodder trees 2. Report on the establishment of contour bunding demonstration plots 3. Database on sorghum-soybean intercropping 4. Farmer exchange visit 5. Journal article 6. PhD thesis | 1. No 2. No 3. No 4. Yes 5. No 6. No | 1. 40 farmers were trained on nursery based agroforestry using fodder trees. 2. 50 farmers were trained on CB implementation. 3. Database was submitted to data manager for uploading. 4. Farmers’ exchange visit conducted. [Africa RISING: Technology parks herald a new beginning in Mali’s farms – ICRISAT](https://www.icrisat.org/africa-rising-technology-parks-herald-a-new-beginning-in-malis-farms/). 5. Manuscript published. <https://doi.org/10.5296/jas.v9i2.18513>. 6. Handbook chapter has been submitted and is under review 7. PhD thesis defended (Bamako University) and the candidate was awarded a degree | |
| Activity 1.2.2:  Test and promote water management technologies and practices to increase water productivity in the small-scale crop-livestock farming systems under rainfed and irrigated conditions. | Sub-activity MA1221-21: Evaluate improved irrigation technologies for efficient and sustainable agricultural water management in rural Mali. | 1. Report on land and soil characterization of potential agricultural investment zones. 2. Multi-criterial decision-making (MCDM) tool developed as a planning and management solution to assess the potential of agricultural water management investments. 3. Multi-stakeholder discussion supporting the promotion of solar energy pumps and improved irrigation technologies to smallholder farmers 4. Finalization of the West Africa Handbook chapter in collaboration with the co-authors as a team | 1. No  2. No  3. No  4. No | Delivered   1. [https://hdl.handle.net/10568/113774](https://hdl.handle.net/10568/113774" \t "_blank). 2. A manuscript on MCDM is under preparation. 3. Multi-stakeholder discussion conducted and findings included in this report. 4. Handbook chapter has been submitted for review | |
|  | Sub-activity MA2221-21  Training of farmers on postharvest and processing technologies | * + - 1. Report on the training sessions       2. Report on farmers’ preferences with respect to postharvest technologies       3. Article on the effect of manure application on tomato qualities       4. Contribution to the WA handbook of technologies finalized | No deviation | 1. Training sessions done 2. Farmers’ preferences with respect to postharvest technologies were done 3. Article has been submitted | |
| Output 3.1  Activity 3.1.1  Review of existing policies and institutional arrangements affecting equitable access to production assets and markets | Sub-activity MA3112-21 Analyze the enabling environment including policies and institutional arrangements and intervention to identify factors that enable the inclusion of women and youth along irrigated vegetable value chain in Mali | 1. Database and qualitative dataset on enabling environment facilitating the scaling of irrigation and water solutions. 2. WA technology handbook. | No deviation | 1. This report is submitted to Africa RISING for reviewing   <https://cgiar-my.sharepoint.com/:f:/g/personal/t_minh_cgiar_org/Ekt-POFRQTFFh7RMZE8D_XgBH2w5Es9R4DFFkPfhs24vxA?e=qK2BoI>   1. Contribution submitted to book chapter 5: Submitted <https://cgiar-my.sharepoint.com/:f:/g/personal/t_minh_cgiar_org/Eq1bYG07aX5Fk-rA1RN1ZRMBbv4LJXMnFXvs906rXE9tGA?e=7X9GbO> | |
|  | Sub-activity MA3121-21  Assessing the inclusiveness of women and youth within the vegetable production value chain to enhance vegetable production among smallholder farmers | 1. Reports on linkages created (contracts formalized) 2. Baseline survey data 3. Report on community forums organized 4. A brochure on seed production, water, and fertilizer management *(Feb 2022)* 5. Report on women and youth involved in seed and inputs value chain through seed production of key vegetable species *(May 2022)* 6. 6. A report on knowledge and information sharing forum *(Jun 2022)* | There is no deviation from planned milestone | * + - 1. Ongoing       2. Data collected, report will be ready by September 2022       3. Started in April 2022       4. Ready for onion; Link: https://docs.google.com/presentation/d/1shJPquyIghESXphjDIHjxnip61teyiul/edit?usp=sharing&ouid=110656574579300187071&rtpof=true&sd=true       5. Report under internal review Report under internal review | |
| Output 3.2  Activity 3.2.1  Identify constraints to, and opportunities for increasing women and youth access to production assets in the target area | MA3212-21 Co-identify value chain-based scaling pathways for irrigation technologies and water solutions with farmers and other actors of vegetable value chains in the Africa RISING sites in Mali | 1. Qualitative dataset on technology and scaling option and vegetable value chains in Mali 2. Report on the technology and scaling pathways co-identified in two Africa Rising sites in Mali 3. Paper based on this year’s data and research on systemic scaling of irrigation technologies and water solutions along irrigated value chains | There is no deviation from the milestone | 1. The report is submitted to Africa RISING for reviewing 2. Completed 3. Under the International Water Management Institute’s internal review for quality control | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Project Outcome 4: Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices. | | | | |
| Output/Activity | Planned Activities | Planned Milestone | Deviation from Planned Milestone | Achievements towards output |
| Output 4.1 Activity 4.1.1: Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts. | MA4111-21  Evaluate the impact of Africa RISING investment on the Return on Investment (ROI) | * + - 1. Technical report       2. Journal article submitted for publication. Title: Evaluate the ex-ante impact of Africa RISING investment on the Return on Investment (ROI): Case of Contour Bunding Technique in Mali       3. Information brief shared with the wider audience       4. Webinar presentation | There are no deviations in the planned milestones. | Data on FGD completed and analysed. The technical report is being developed  1. Manuscript was submitted for publication 2. A webinar presentation is planned for July 2022 |
| Output 4.3A framework for monitoring and evaluating technology adoption, and technology-associated risk accessible to the project team and scaling partners. | Sub-activity MA4312-21: Assess the impact of Innovation Platforms on SI technology uptake in Africa RISING interventions communities. | Publication on impact of IPs in technology dissemination and impact on strengthening and sustaining multi-stakeholder innovation platforms.  Finalization of the West Africa Handbook chapter in collaboration with the co-authors as a team. | There are no deviations from the planned milestones | * + - 1. Scientific article in progress       2. Chapter submitted |
| Output 4.3  Activity 4.3.1  Monitoring and modify the progress of the technology adoption process towards scaling | Sub-activity MA4313-21:  MA4313-21  Mapping trends of rainfall onsets, cessation and length of the rainy season in Segou, Sikasso, and Mopti regions | GIS maps showing the spatial extent of technology adoption  Manuscript on gender-disaggregated technology adoption for the two agro-ecologies in Koutiala and Bougouni districts  Finalization of the West Africa Handbook in collaboration with the co-authors as a team | There are no deviations to the planned activities. | 1. Delivered and shared with chief scientist 2. Scientific article in progress 3. Input has been submitted to the chapter leader |
| Output 4.4  Activity 4.4.1  Establish knowledge-sharing and learning alliances among scaling actors | Sub-activity MA4411-21  Manage the operations of four technology parks as hubs for innovation, research, extension, advisory, coordination, and demonstration in Bougouni and Koutiala | * + - 1. Biophysical database on improved technological practices and participatory research in the technology parks.       2. Manuscript on approach to technology parks use, technology validation and dissemination, capacity building, and lessons from farmers’ field visit.       3. Finalization of the West Africa Handbook in collaboration with the co-authors as a team.       4. Hand over meeting lead by FENABE in Bougouni and AMEDD in Koutiala district involving all partners (ONG, Technical services, communal authorities) | There are no deviations to the planned activities. | 1. All biophysical data were collected following the research protocol. 2. Contribution was made to the Africa-wide scaling paper with the title *‘Delivering and scaling out agricultural technologies to smallholder farmers in Africa: lessons from the Africa RISING program’* 3. Handbook chapter submitted 4. This has been done with all the partners of the project. |

**B.1. Achievements (progress and/or results) against outputs towards outcome 1**

**MA1111-21: Evaluating crop simulation models using different fertility sources and climate model outputs to improve the productivity of sorghum**

1. Progress of manuscript focused on ***“Impacts of fertilization management strategies on improved sorghums varieties in smallholder farming systems in Mali: productivity and profitability differences”***  submitted in Heliyon journal.
2. Submitted an abstract titled “ ***modeling approach to evaluate micro-dosing fertilization Strategy on sorghum productivity under the projected mid-century climate scenario in Mali Savanna agro-ecologies”***

**MA1112-21: Understanding soil fertility management in cereal cropping systems in southern Mali**

Moumine Guindo went to Niamey, Niger for three months (March-May 2022) to work closely with his immediate supervisor Dr. Bouba Traore and produced two articles:

1. Biomass and Nutrient Flow Dynamics from Households to Farm Fields: An Experimental Study in Southern Mali resubmitted to Nutrient Cycling in Agroecosystems (FRES-S-22-00016) after revision.
2. Scientific article published in the Journal of Agronomy on Microdosing of Compost for Sustainable Production of Improved Sorghum in Southern Mali (<https://www.mdpi.com/2073-4395/12/6/1480/htm>)

**MA1113-21: Testing adaptation of dual purposes sorghum hybrids in Mali to diversify options for crop-livestock integration.**

**Analysis, interpretation and discussion of achievements**

Data was sent to the consultant and the analysis is ongoing and will soon be submitted to a well-known journal for publication.

**Sub-activity MA1131-21: Risk management and informed decision making towards sustainable intensification of crop-livestock systems.**

**Publication of scientific article:** <https://doi.org/10.1111/dpr.12605>

Second article is ongoing

***Objective 2: To scale the use of a farm planning and budgeting tool for improved farm management***

**Tables and graphs in support of achievements**

*Table 1 : Dates and teams of trainers for the villages*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **23-24 March 2022** | **25-26 March 2022** | **27-28 March 2022** |
| Team 1 | Ntièsso | Msesso | Nitabougoro |
| Team 2 | Signè | Derezso | Nampossela |

**Analysis, interpretation and discussion of achievements**

**Materials and methods**

A series of training workshops were implemented in plenary sessions for two days. The training covered the presentation of the tools and the guidelines, as well as the planning, monitoring and evaluation modules. For each module, a theoretical presentation was made, then followed by a practical exercise based on concrete examples relevant to the local context. The participation was voluntary based on the interest to use the tools in farm management and the availability of semi-literate persons within the farming household to use the tool. Particular attention was paid to the participation of women and young people in the training session, but also to the use of the tool. The training materials included (1) the three modules of the DST (in the local language Bamanankan), (2) the user guide (in the local language Bamanankan) and (3) the practical exercises (French version but translated into Bamanankan for producers). All the training materials can be found in the zip file that can be downloaded from the following link:

<https://www.dropbox.com/s/3fu2k18vhxrh33o/training%20materials.zip?dl=0>.

**Approach to the dissemination of tools**

Two dissemination approaches have been adopted, namely the "producer-to-producer" approach and the "agent-to-producer" approach. The "producer-to-producer" approach is based on assistance from relay producers to other producers within the community. The two relay producers with good reading and writing abilities in Bamanankan were selected to play the role of the relay within the village community, to train and assist other producers. The advantages of relay producers are: (1) they share the same constraints as the other producers, (2) they live in the village community, which makes them more accessible to other farmers, and (3) the reliance on them is more cost saving than other options.

The "agent-to-producer" approach is based on the assistance of a development agent to one or more producers after the training. The extension agent of the CMDT working in the villages was selected to play this role. The “agent-to-producer” approach is interesting if qualified agents are available to assist farmers, however, their involvement is very costly. Also, qualified agents are often not stable as they can leave at any moment for another position, leading to disruption.

1. **Implementation of the training**

The duration of the training workshop was two successive days (Table 1). The first day covered the planning of food, feed, income, and manure needs, using the planning module. The second day focused on the recording of crop operations and the use of inputs throughout the season (using the monitoring module) and the evaluation of performance and achievements of annual needs (evaluation module). The training workshops took place from 21 to 28 March 2022. The first two days (from 21 to 22 March) were to train 12 relay producers in Koutiala city on how to use the planning, monitoring and evaluation modules and how to assist other producers. Then, training workshops were implemented from 23 to 28 March, in six villages by two teams of trainers with each team implementing a two-day workshop per village. The number of beneficiaries per workshop ranged from 21 to 24 participants, including the extension officer of the CMDT. In total, each team was able to train about 60 producers and an extension officer in three villages from 23 to 28 March 2022.

**Results**

The number of people trained:

* 145 producers trained in six villages, including 26 women.
* Twelve relay producers, on the basis of two people per village,
* Six extension agents, including 4 women and 2 men.
* Six trainers.

The number of villages: six villages in Koutiala district, including Ntièsso, M'Peresso, Nitabougoro, Signe, Deresso and Nampossela. Number of user’s guide: in total 24 documents of the user’s guide have been disseminated among producers and extension agents.

**Conclusion**

The training workshops were successfully implemented as planned. Producers and extension agents were trained on how to use the planning, monitoring and evaluation modules. The user’s guide to support the implementation of the DST was disseminated among producers and extension agents. Overall, the workshops were informative and interesting both for the trainers and for the participants. Many producers indicated that the new skills learned from the training would be incorporated into their management efforts. Especially, farmers were happy to know the explicit formulation of their farming objectives is an important step for better management of limited farm resources.

**Sub-activity MA1211-21: Assess cropping management factors using empirical relations, GIS and Remote Sensing tools in two agro-ecologies of Mali.**

Revised reviewers’ comments and re-submission of scientific article on Landscape Pattern Analysis Using GIS and Remote Sensing to Diagnose Soil Erosion and Nutrient Availability In Two Agroecological Zones of Southern Mali (AAFS-D-22-00004R2) in the journal of Agriculture and Food Security.

**Sub-activity MA1212-21: Improving crop-livestock productivity and household income through the use of contour bunding and agroforestry options.**

A PhD Thesis was defended (26 May 2022) by Mr. Cheick Oumar Dembele at University of Bamako. A scientific articles was published.

Cheick Oumar Dembele, Kalifa Traore, Moussa Karembe, Birhanu Zemadim, Fotigui Cisse, Oumar Samake (2021). Contour Ridge Tillage for Improved Crops and Fodder Trees Production in the Villages of Kani and Noumpinesso, Southern- Mali. Journal of Agricultural Studies, 2021, Vol. 9, No. 2, 550-572. <https://doi.org/10.5296/jas.v9i2.18513>.

**Sub-activity MA1221-21: Evaluate improved irrigation technologies for efficient and sustainable agricultural water management in rural Mali.**

**Planned activities**

**Table 2:** Research questions under the sub-activity MA1221.

|  |
| --- |
| 1. **Identify appropriate solar pump for Africa RISING in the intervention area**  * To identify appropriate technology for ecologically sustainable agricultural water management interventions, * Determine small-scale irrigation technologies for the farmer, * Identify soil moisture conservation technologies. |
| 1. Develop an appropriate and affordable methodology for scaling |
| 1. **Market accessibility**  * Identify a pathway for the farmer to deliver the product into market * Transformation/conservation methods |
| 1. **Potential reliable linkage among different stakeholders**  * Identify available resources for scaling * Challenges and opportunities for scaling of solar pump irrigation identified * Roles of actors in collaboration for scaling pathway |

## Analysis, interpretation and discussion of achievements

A focus group discussion was held on 11 February 2022 in the district of Koutiala to discuss a possible public private partnership (PPP). Fifteen national (Chamber of Agriculture, OPV) organizations (World Vision, Malimark, AMEDD), seed companies (Zamoha), farmer representatives and traders, and solar pump company intervenient in the system participated in the focus group discussion. During the FGD the main objective was explained to participants, and each question (Table 2) was briefly discussed. The participants were then grouped into two and each group presented it’s results at the end of the group discussion.

**The results from the discussion were:**

**Main constraints and solutions were proposed to scale the district's solar pump**.

* Most farmers are smallholders with limited income, and installing solar pumps is expensive.
* Lack of technicians to advise on the best use of the technology.
* In the district, the production from the garden is exported to Burkina Faso and Ivory Coast and they propose the price to be determined by the producers themselves.
* As is done everywhere in Mali, all the farmers produce at the same time in the dry season and there is a lack of conservation techniques.

**Proposed solutions**

* Put the solar pumps in promotion with a wide distribution,
* Cooperatives can be a source of settlement and information because they are organized in groups,
* Mobilize and train all actors throughout the value chain,
* Develop projects on using solar pump project.
* Organize exchange visits which will create greater awareness among the actors,
* Troubleshooting method and cost for renewable energy,
* Ways to gain from such an investment,
* Organize traders in groups allowing them to have fixed prices benefiting them,
* Use of water retention techniques that will increase groundwater.

**Actors and Roles**

* Media: wider distribution of information
* Technical and financial partners: awareness, training, information, financial support
* Producers: production and sale
* Companies: bring new solar technologies

**References to documents in support of achievements**

1. Traore, S., Zemadim, B., and Kizito, F. 2021.Irrigation technologies for efficient and sustainable agricultural water management in rural Mali focusing on land and soil characterization of potential agricultural investment zones in Bougouni and Koutiala. Ibadan, Nigeria: IITA. <https://hdl.handle.net/10568/113774>
2. Sanogo, K. and Zemadim, B. 2021. Improved irrigation technologies for efficient and sustainable agricultural water management in rural Mali: Results Based on the Sustainable Intensification Assessment Framework. Ibadan, Nigeria: IITA. <https://hdl.handle.net/10568/113759>

## Section B: Capacity Building

* A PhD candidate named Moumine Guindo went to Niamey, Niger for three months (March-May, 2022) to work closely with his immediate supervisor Dr. Bouba Traore and finalize his study. All costs related to flight, accommodation and stipend have been covered by the Africa RISING project.
* A Ph.D. Thesis was defended (26 May 2022) by Mr. Cheick Oumar Dembele at the University of Bamako.
* 257 (70% women) producers trained (125 in Koutiala and 132 in Bougouni) on postharvest management and processing techniques.
* Four students, one of whom is from the agricultural school of Konobougou (technician), one, a bachelor's degree student and two master’s degree students, have completed their training with us in Kani and got their diplomas. The topic of study was the evaluation of CB technology on soil, trees and crops. More than 100 farmers have been trained on CB and nursery implementation. A scientific article has been published.
* 145 producers, including 26 women, were trained in six villages, onfarm planning and budgeting tool for improved farm management.

## Section C. Problems/challenges and measures taken

Since availability of livestock feed is a concern in the project area, there is a need to train farmers in selling seedlings, making wooden fences, soybean condiments (soumbala) and planting fast growing tree species on contour bunded fiends.

There is a need to continue working on land management practices in erosion prone areas. This requires continuous engagement of researchers, field technicians and local NGOs.

## Section D. Partnership/linkages with other projects

Bougouni community benefited from Amaranth varieties promoted by the BMW-WorldVeg project in Mali. This project aimed at promoting indigenous vegetable production and consumption.

## Section E. Lessons learned

It was a great pleasure to see how many women farmers occupied the technology parks of Madina and N’Golonianasso with their own vegetable activities. They grow lettuce, tomato, shallots, pepper, African eggplant, watermelon, etc. The technology parks are busy all day with project beneficiaries. They also made repairs to defective materials in the irrigation systems to avail water for their activities. The project activities are impacting farmers’ practices and livelihoods in the project intervention zones. Farmers are continuing to demand CB technology since its immediate effect on the ground was seen in the first year of implementation. The technology of CB reduces runoff and erosion, increased crop and tree growth, and yield. The demand for fodder plants is also high since farmers start to feed animals with plant biomass. Appropriate fertilization management strategy along with an improved sorghum variety tested has demonstrated increased productivity for food and feed leading to improved livelihood of smallholder farmers and enhanced food security in sub-Saharan Africa.

**Section F. Monitoring and Evaluation**

**F.1. Feed the Future indicators**

Tabulation with the following columns: (i) FtF indicator, (ii) Annual target (iii) Progress toward target, (iv) Segregation, (v) explanation for over/under achievement (only for full report)

Info must also be provided to the Africa RISING Economist and/or to the project M&E specialist when needed for reporting to USAID FTFMS (usually during October each year) using PMMT.

**F.2. Custom indicators**

Tabulate (i) Custom indicator, (ii) Annual target, (iii) Progress toward target, (iii) explanation for over/under achievement

# Section G. Success stories

Contour bunding technology has been successful during the project entire period. The technology has increased crop yields by 30% to 50%. The same technology has also recharged the water table, soil moisture, runoff and erosion. It has affected the crown, biomass, and fruits of trees in different fields at Sikidolo, Kani and Noumpinesso in Mali.

“Cost-benefit analysis revealed five best fertilization strategies and two improved sorghum varieties, have shown great potential to increase farmers’ productivity compared to their current practice.” The statement was further attested by farmers in Koutiala district based on on-farm demonstration technology. They said higher grain yield was produced from either Fadda or Soumba compared to their local variety despite late planting time due to delayed rainfall.